

# The World Market for Thermal Flowmeters, 2<sup>nd</sup> Edition

— Overview —



**Publication Date: January 2018**

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## The World Market for Thermal Flowmeters, 2<sup>nd</sup> Edition

Flow Research is pleased to announce a new market study on the worldwide thermal flowmeter market, **The World Market for Thermal Flowmeters, 2<sup>nd</sup> Edition**. The primary goals were to determine the 2016 size of the thermal flowmeter market and the market shares of major suppliers. Forecasts through 2021 for a variety of segmentations have been included.

The study achieves multiple objectives:

- To determine 2016 worldwide market size and market shares for thermal flowmeters
- To forecast market growth for all types of thermal flowmeters through 2021
- To identify the industries and applications where thermal flowmeters are used, and to identify market growth sectors
- To provide a product analysis for the main companies selling into the thermal flowmeter market
- To provide strategies to manufacturers for selling into the thermal flowmeter market
- To provide company profiles of the main suppliers of thermal flowmeters.



### Rationale for Study

Flow Research has been following the thermal flowmeter market for the past fifteen years. Since 2002, we have provided quarterly updates in our **Market Barometer** publication ([www.worldflow.com](http://www.worldflow.com)), and we include data on the overall thermal market size worldwide and by geographic region in each edition of our worldwide market study, **Volume X: The World Market for Flowmeters**. Some of the growth in this market is due to expansion in the need for environmental monitoring, such as rising requirements to measure greenhouse gas emissions, a subject that we regularly cover in our other quarterly, the **Energy Monitor**.

The first edition of this worldwide study was published in 2009. There have been many changes in this market during the intervening years. We believe that this has been an optimal time to again quantify the size of the worldwide and regional markets, and to take an in-depth look at the factors both supporting and limiting the potential for future growth.

## Background

One of the most interesting development areas today among the new-technology flowmeters is in thermal flowmeters. This is due in part to the fact that this technology is still relatively young. Thermal meters grew out of hot wire anemometers, whose roots go back to the early 1900s. However, it was not until the 1960s that thermal flowmeters were developed from them. While thermal flowmeter devices have been around almost as long as ultrasonic (1963), and longer than Coriolis (1977), they have not yet evolved to the same degree as these competing technologies.

Both thermal and Coriolis flowmeters measure mass flow. However, thermal meters measure mass flow quite differently than Coriolis meters. Instead of using fluid momentum, as do Coriolis meters, thermal flowmeters determine mass flow through measurement of the thermal or heat conducting properties of fluids. While most thermal flowmeters are used to measure gas flow, a small percentage also measure liquid flow.

Hot wire anemometers consist of a heated, thin wire element, and are very small and fragile. Hot wire anemometers were used in velocity profile and turbulence research. Because they are susceptible to breakage and to dirt, they are not suited to industrial environments. Industrial thermal flowmeters use a similar concept of measuring the speed of heat dissipation to determine mass flow, but use more rugged sensors that are better adapted to industrial environments.

### Key Issues Addressed

This study addresses key issues in the thermal flowmeter market, including:

- The use of thermal flowmeters for continuous emissions monitoring (CEM)
- The growing use of thermal flowmeters for environmental monitoring applications
- The use of insertion thermal flowmeters for flare gas measurement
- The role of thermal flowmeters in measuring greenhouse gas emissions
- The increased number of suppliers to this market
- New product and technology developments
- Growth strategies for thermal flowmeter suppliers

## Operating Principle

Thermal flowmeters are used almost entirely for gas flow applications. As the name “thermal” implies, thermal flowmeters use heat to measure flow. Thermal flowmeters introduce heat into the flowstream and measure how quickly this heat dissipates, using one or more temperature sensors. This method works best with gas flow measurement because gases are more sensitive to the presence of heat than liquids.

While all thermal flowmeters use heat to make their flow measurements, there are two different methods for measuring how quickly the heat dissipates. One method is called the “constant temperature differential” method. Thermal flowmeters using this method have two temperature sensors: a heated sensor, and another sensor that measures the temperature of the gas. Mass flowrate is computed based on the amount of electrical power required to maintain a constant difference in temperature between the two temperature sensors.

A second method is called a “constant current” method. Thermal flowmeters using this method also have a heated sensor and another one that senses the temperature of the flowstream. The power to the heated sensor is kept constant. Mass flow is measured as a function of the difference between the temperature of the heated sensor and the temperature of the flowstream. Both methods rely on the idea that greater cooling results from higher velocity flows. Both measure mass flow based on the measured effects of cooling in the flowstream.

Below is the segmentation of the research used in this study:

## Study Segmentation

### Geographic Regions

- North America
- Western Europe
- Eastern Europe/FSU
- Middle East/Africa
- China
- Japan
- Asia/Pacific (without Japan and China)
- Latin America



### Thermal Flowmeters by Mounting Type

- Inline
- Single Point Insertion
- Multipoint Insertion

### Thermal Flowmeters by Fluid Type

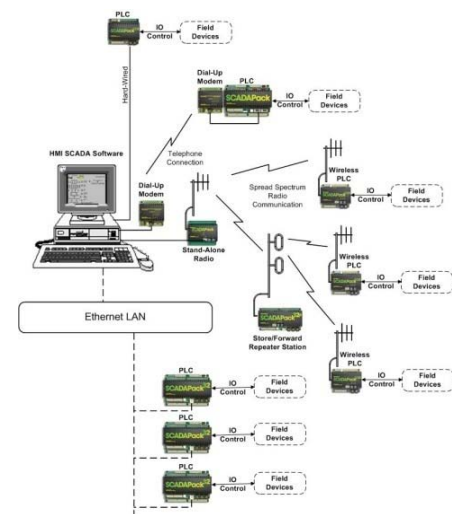
- Air/Gas
- Liquid

### Thermal Flowmeters by Intelligence Level

- Smart
- Conventional

### Smart Thermal Flowmeters by Communication Protocol

- Foundation Fieldbus™
- HART
- Profibus® DP
- Profibus® PA
- Modbus®
- Other



### Thermal Flowmeters by Industry

- Oil and Gas Production, Transportation, and Distribution
- Refining
- Chemical
- Food & Beverage
- Pharmaceutical
- Pulp & Paper
- Metals & Mining
- Electrical Power
- Textile
- Water & Wastewater
- Other



### Thermal Flowmeters by Application

- Continuous Emissions Monitoring (CEM)
- Flare Gas/Flue Gas
- Landfill Gas Recovery
- Biogas Recovery
- Biomass Fermentation and Recovery
- Coal Mine Methane Recovery
- Boiler Inlet
- Wastewater Treatment
- Air/Compressed Air
- Sanitary/Hygienic
- Natural Gas Submetering
- Other



### Thermal Flowmeters by Distribution Channel

- Direct Sales
- Independent Representatives
- Distributors
- E-Business

### Thermal Flowmeters by Customer Type

- End-Users
- OEMs
- Systems Integrators
- Engineers/Consultants





### The study provides the following information

- Shipments of thermal flowmeters in revenues and units worldwide and by region in 2016, with forecasts through 2021
- Shipments of thermal flowmeters by type worldwide and by region in 2016
- Average Selling Price of thermal flowmeters by type worldwide and by region
- Shipments of inline thermal flowmeters worldwide and by region
- Shipments of single point insertion thermal flowmeters worldwide and by region
- Shipments of multipoint insertion thermal flowmeters worldwide and by region

### Other vital information in this study



- Growth rates worldwide and by region
- Discussion of market forces at work
- Market shares for the leading suppliers of thermal flowmeters
- Detailed product descriptions by supplier
- Company profiles
- Strategies for success

Company Profiles	
<p><i>We provide complete company profiles on the leading thermal flowmeter suppliers. The following is a partial list of the companies profiled in this study:</i></p>	
<ul style="list-style-type: none"> <li>• ABB</li> <li>• BinderGroup</li> <li>• Eldridge Products</li> <li>• Endress+Hauser</li> <li>• Fluid Components International (FCI)</li> <li>• Fox Thermal Instruments</li> </ul>	<ul style="list-style-type: none"> <li>• Kurz Instruments</li> <li>• Magnetrol International</li> <li>• Sage Metering</li> <li>• Sierra Instruments</li> <li>• Thermal Instrument Company</li> <li>• Tokyo Keiso</li> </ul>

### The Coming Age of Thermal Flowmeters

In the past, thermal flowmeters have been significantly helped by environmental regulations. In the early 1990s, new environmental regulations began requiring companies to detect and reduce the emission of sulfur dioxide (SO<sub>2</sub>) and nitrous oxide (NOX) into the air. SO<sub>2</sub> and NOX are two principal causes of acid rain.

The Environmental Protection Agency (EPA) initiated a program to reduce pollution in the atmosphere. It is possible to determine how much of these substances are released into the atmosphere by combining a measurement of the flowrate with a measurement of the concentration of SO<sub>2</sub> and NOX. EPA regulations have resulted in the development of an entire industry around the monitoring of continuous emission systems. Specifically, the CEM industry.

In response to CEM requirements, thermal flowmeter companies developed multipoint thermal flowmeters. In many cases, continuous emissions monitoring occurs in large stacks that emit industrial pollution. Single point thermal flowmeters measure flow at a point, making it difficult to accurately compute flow in a large pipe or smokestack. Multipoint thermal flowmeters measure gas flow at multiple points, and use these values to compute flow for the entire pipe, duct, or stack. Some multipoint flowmeters have as many as 16 measuring points.

While the need for CEM is ongoing, the 21<sup>st</sup> century has brought new environmental awareness and requirements. Scientific thinking has evolved substantially in the past ten years. While global warming and the need to reduce carbon emissions were once viewed as scientific theory, they are now widely accepted as scientific fact. In the United States, the Obama administration made a commitment to reducing greenhouse gas emission 80 percent by 2050. While the Trump administration is less sympathetic to climate change issues, it is facing opposition as it attempts to roll back some regulations. Some companies and groups welcome this, but some have pledged their continued commitment regardless of the administration. It is too early to tell what the ultimate impact of this less environmentally friendly administration will be.

Working to reduce greenhouse gas emissions has become a more global focus. The Kyoto Accord, an international treaty designed to reduce greenhouse gas emissions, has resulted in the creation of several mechanisms that require measurement of greenhouse gases. These include Certified Emission Reductions (CER), which allow noncompliant firms to purchase carbon emission credits from companies within compliance. Another program is the Clean Development Mechanism (CDM), which allows countries to invest in sustainable development projects that reduce emissions in developing countries.

The new age of environmental awareness, together with the Kyoto Accord and other greenhouse gas initiatives, has resulted in a rewriting of the rules on measuring greenhouse gas emissions. There is subsequently a need and a demand to measure greenhouse gases in applications that formerly may have been overlooked. Many of these applications present opportunities for thermal flowmeters, including the following:

- Measurement and recovery of landfill gas
- Ethanol distillation and refining
- Measuring emissions from steam generators, boilers, and process heaters
- Biomass gasification
- Recovery of methane from coal mines
- Monitoring of flue gas
- Measurement and monitoring of flare gas flow

## **Flow Research Team**

### **Dr. Jesse Yoder**

Dr. Jesse Yoder is President of Flow Research Inc., a company he founded in 1998. Dr. Yoder has 30 years of experience as a writer and an analyst in process control and instrumentation. He has given presentations at conferences and seminars, and done webinars. Since 1995, he has written more than 250 market research studies, most of them regarding flow and instrumentation. Dr. Yoder has also written more than 280 articles on flow and instrumentation for trade journals. Links to many of these articles can be found at [www.flowarticles.com](http://www.flowarticles.com). He has also written two books. His latest book, *The Tao of Measurement, A Philosophical View of Flow and Sensors*, by Jesse Yoder and Richard E. Morley, as co-contributors, was published in January of 2015 by the International Society of Automation (ISA). This book looks at the past, present and future of flow, sensors and measurement. Dr. Yoder has received two patents for new flowmeter designs. Several prototypes of these designs have been built and are currently being tested.

**Belinda Burum**, Vice President, worked in journalism and advertising, then in high tech as a writer, marketing communications manager, and customer references consultant. She joined Flow Research in 2002, and has worked on many projects, studies and publications.

**Norm Weeks**, Senior Market Analyst, joined Flow Research in November 2004 after 24-years with Verizon specializing in innovative solutions for major enterprises, introducing new products and lifecycle management strategies, and product marketing. He also served as Director of the Urban Fellows Institute in New York. At Flow Research, he is involved in project development, research, analysis and writing. In addition to working on our off-the-shelf studies, custom projects are a specialty. He also contributes to White Papers, Worldflow and other publications.

**Harry Lund**, Sales Director, joined Flow Research in October 2016. He has 45 years experience in the flow measurement industry with several US and international corporations. From beginning as a technical writer, he advanced through communication systems, application engineering, and product management to VP Sales, Service, and Marketing. At Flow Research, his experience and skills with people, products and the flow measurement business world are a valuable resource for our customers and us. Harry also has a forte for formulating strategies to enable companies to compete more effectively in the marketplace.

**Leslie Buchanan**, Publication Production Associate, and Research Assistant, joined Flow Research in March 2010, with skills from a variety of work and life experiences. Early on, she worked on the database, customer contact, and publication formats. She became increasingly involved in many capacities with Flow Research studies, Worldflow and other publications.

**David Goldstein**, Business Analyst, joined Flow Research in September 2016. He has an MBA from Boston University and 30 years of professional experience including various management positions in Sales and Marketing with consumer product companies. David developed products and programs for customers as large as Wal-Mart and as small as independent corner drug stores. At Flow Research, he combines his market research and business analyst skills with his astuteness and organizational abilities to assist with research and writing for studies and projects.

**Victoria Tuck**, Administrative Assistant, joined Flow Research in June, 2012. She has experience in both the fast-paced law firms of Boston, and in various nonprofit organizations. She handles a variety of office functions – essential to keep any business running – as well as assisting in other ways, including the contacts database and news for the Worldflow publications.

**Christina Glaser**, Website Design & Maintenance, joined Flow Research in October 2010. She is a seasoned software programmer, systems architect, and developer with significant website experience. At Flow Research, she took on the major role of refreshing, improving, organizing and maintaining our many company websites, also gathering news content for some.





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*Robert Boyle*

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To produce studies that most closely match our clients' needs, Flow Research instituted the Founding Sponsor Program. This program enables companies who wish to participate at a high level in a study's research to influence its scope and segmentation. In addition, Founding Sponsors receive regular updates from Flow Research on study progress, and receive a significant discount on the regular price of the study.

Procedure: Early in the planning phase of a study, Founding Sponsors receive a proposal that includes the proposed segmentation. Founding Sponsors can propose additional segmentation, and can also suggest changes to the proposed segmentation. While the decision to adopt particular segmentation ultimately lies with Flow Research, and is based on input from all contributors, we will do our best to accommodate the specific needs of each of our clients.

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- You are among the first to receive final study results
- You receive favorable pricing and other purchase terms

If you have any questions about the Founding Sponsor program, please contact Norm Weeks at +1 781 245-3200, or [norm@flowresearch.com](mailto:norm@flowresearch.com)

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### **Why Flow Research?**

- We specialize in flowmeter markets and technologies
- We have researched all flowmeter types
- We study suppliers, distributors, and end-users
- Our worldwide network of contacts provides a unique perspective
- Our mission is to supply the data that will help your business succeed

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